posure of the tissues to atmospheric oxygen, in the presence of oxidizing enzymes, causing the oxidation of colorless substances to those of varied color. During the normal life of the plant it seems to be able to hold these enzymes in check, but after death or interference with its functions, the enzymes run riot; thus causing blackening and colorations of many sorts. The blackening of the foliage of many plants after a frost and the production of the red and gold of our atuumn forests may well be due to the excessive activity of the oxidizing enzymes. The color of black tea, the odor of valerian, the aroma of vanilla-beans, etc. have all been attributed to this same cause. The presence of these ferments in the roots of growing plants seem to enable them to destroy certain poisonous substances in the medium in which they grow. There is a disease of tobacco known as the 'mosaic disease' which is characterized by the checkered appearance of the leaves, these checkered places being yellow in color. Woods showed that rapid growth, produced by cutting back or by excessive manuring, often caused this disease which he attributed to an abnormal activity of the oxidizing enzymes. It has also been shown that they may cause the destruction of chlorophyll. Now, most of the lower fungi contain these enzymes, so the yellowing produced by their attacks upon green leaves may be due to their activity. It is evident then, that in the plant the oxidizing ferments have a physiological and also a pathological rôle that are not well understood but which deserve further investigation."

Dr. P. A. Rydberg reviewed the Monograph of *Sambucus* by Fritz Graf von Schwerm. This paper will be published at a later date.

Adjourned.

PERCY WILSON,
Secretary

OF INTEREST TO TEACHERS

THE BOTANY UNIT

At the March meeting of the Commission on Accredited Schools of the North Central Association (including 13 states), the botany unit statement mentioned earlier in TORREYA was adopted.

"It has been the intent of the committee to prepare a statement that is sufficiently elastic to give adequate recognition to all good courses in high school botany, rather than to present a set line of procedure that must be followed by all. The work that is done should meet the needs of the pupils regardless of whether any work is to be done in any higher institution. Emphasis is placed upon the quality and quantity of the work done, and upon the preparation of the teacher, rather than upon the particular things that are to be done. To this end the report considers the following: I. The purpose and content of the course and the time to be given to it; II. Suggested plan of the course; III. The preparation that should be had by the teacher of botany; IV. A list of topics from which selection may be made to construct a course."

From the first topic four extracts are given:

1. "The ends to be sought through an elementary study of plant life include training in the scientific method of thinking particularly as relates to plant life, information and a more intelligent and a more active interest in natural phenomena in general, an elementary knowledge of fundamentals of plant life and a better understanding of those features and activities of plants that relate to every day affairs."

2. "In determining the content, order and treatment of topics in any indiviudal course, the needs and opportunities of the teacher and class should be dominant. * * * The quality and quantity of work done by the pupil, evidence of his ability to do accurate and reliable work, and adequate preparation by the teacher, rather than the specific content of the course are emphasized."

3. "There is presented a general plan of the 'synthetic course,' which the majority of the committee believes to be the best type, though it is not intended to restrict teachers to this type of course. This course embodies the elements of morphology of the great groups including the "lower forms" as well as the seed plants, of physiology with experiments upon plant activities, of ecology with emphasis upon class and individual field trips, including some acquaintance with local plants, of the relation

of plants to their habitat and to men, of food and timber supply, parasitism, disease, decay, soil replenishment, etc.

"An elementary consideration of the relations of plants to men as shown in plant and animal diseases, hygiene, agriculture, horticulture, erosion, decay, foods, fibers, etc., should be presented as an organic part of the study of botany. An adequate consideration of such separate applied sciences as agriculture, forestry, bacteriology, and horticulture should follow the general study of plants and animals."

4. "The time requirement of the course should be the equivalent of 180 periods of at least 40 minutes each; there should be two doubled periods per week for laboratory or field work, each of these doubled periods counting as one period in making up the total 180 periods."

The "suggested plan" of the course includes more material than any one year's work can present. The economic and practical phases are emphasized more throughout than in the report of the Committee of Education of the Botanical Society of America.* It is also stated that *any* of the following topics may serve as an introduction to the course, and lead directly to others of the group. The content is indicated below:

1. The structures of a typical seed plant—roots, stem, leaves, flowers, and seeds—and the kinds of work done by these parts.

How the plant lives—elementary, physiological experiments, absorption, root pressure, conduction, transpiration, photosynthesis, relation of functions to the structures by means of which they are performed.

The work of leaves.

The storage of food, its relation to the plant; its relation to men and other animals.

Seeds and seedlings; seed distribution; the establishment of new plants.

Acquaintance with some of the plants of the locality.

2. In addition to the topics just named, owing to seasonal advantage, preferences of the teacher, or needs of the pupils, the following will at times be found best in this connection, while in

*See Torreya **9**: 60–63, 81–85. 1909.

other cases it will be found best to take up these topics after the consideration of the great groups:

Relation of plants to light, soil, water, atmosphere, gravity, contact, seasons.

Growth and reproduction.

Responses of different regions.

Artificial control and methods of improving agricultural and horticultural plants.

Forests, their uses, distribution, dangers, and preservation.

The study of types differs little in range from the recommendation of the Botanical Society. In the cryptogams field work is more definitely recommended; the species selected in each group are in most cases left to the teacher, but the life, habits, and distribution are included with the life cycle requirement. Bacteria in relation to crops, sanitation, and disease occupy a much more prominent part. The suggestions for gymnosperms and angiosperms are reprinted below:

1. Gymnosperms. Pine or spruce as a type; habit of tree, perennial nature, twigs and stems of different ages, age of tree, leaves and the evergreen habit, nature of the timber and its uses; two kinds of cones and the processes, time and structures involved in seed formation, nature of the seed, seed distribution, seedlings and the establishment of the new tree.

Names of other kinds of gymnosperms.

Gymnosperms as source of much of the world's lumber supply, chief regions of gymnosperm forests, preservation and extension of gymnosperm forests.

2. Angiosperms.

Life cycle as compared with the gymnosperms.

Types of stem, root, leaf and flower structure, with consideration of the special work, habits, and uses of each of these.

Nutritive and reproductive processes arranged so as to extend whatever work was done with seed plants at the beginning of the course. Work suggested at the outset that was not done in that connection may be included here.

Pollination and seed formation, number of seeds, seed distribution, seedlings, vitality of seeds, struggle for existence.

Structures and habits of plants of different regions.

Acquaintance with plants of the leading families in the local region.

Angiospermous forests (possibly delay the consideration of gymnospermous forests until this point), the local timber supply either from local forests or from others, enemies of the forests, elementary forestry problems, United States, State, and local private work in forestry.

Relation of plants to soil, water, light, temperature, gravity, and other environmental factors. Productive and unproductive soils and climates in relation to agricultural plants.

Diseases of plants and their significance. Artificial improvement of plants through cultivation, pruning, grafting, selection, and breeding.

The minimum preparation in botany for high school teachers of the subject was decided to be the equivalent of two years of college work. This work should include the general morphology of the lower and higher groups, elementary plant physiology and ecology; zoölogy, physiography, and a course in general bacteriology are desirable. The teacher should also have some knowledge of the purpose of botany in high school education and of current and desirable practice in teaching botany.

A porous clay cup for the automatic watering of plants is described by L. A. Hawkins in the September *Plant World*. Coleus plants were so grown for 180 days, and *Vicia Faba* plants from the seed to the late flowering stage. A container which is at least partially impervious was found to be better than the usual flower pot when the automatic watering cup is used. The plants were as vigorous as the control plants potted and watered the usual way. The advantages of the automatic device are that it maintains an approximately uniform soil moisture, and affords a simple method of measuring "water requirement and water loss of potted plants"; it also decreases the amount of attention required by potted plants and avoids the evils of alternately overwet and baked soil.

The September series of papers on the Paleontologic Record now running in the *Popular Science Monthly* deals with ontogeny and its relation to phylogeny. While the parallel between these is recognized as "a powerful aid to investigation" one paper warns the paleontologist not to assume too much for it. Another concludes that "the young give us very little which is not deceptive in reconstructing ancestral forms." The next paper in the series, however, says "When, however, the student of post-embryonic ontogeny compares the youthful stages of an individual with the adult of immediately preceding species of the same genetic series, the fact of recapitulation becomes at once apparent." The references are mainly zoölogical, but are well worth the botanists' perusal.

In a paper on the economics of waste and conservation in the *Atlantic Monthly* for September John Bates Clark calls attention to the fact the "common allegation is true that a small area of growing trees is capable of meeting the entire demand of the country for lumber", but he briefly adds "It will do so *at a price.*" The "one palliative fact about a monopoly of forests" is that "it would let new forests grow." Still Professor Clark is one of the last to present a plea for monopolies; and he presents the case for forests clearly when he says: "In another respect forestry is peculiar. Conservation not only permits, but requires, the use of the thing that is the object of care. . . . The scientific treatment of forests not only does not preclude a use of them, but positively requires it, and complete disuse is itself wasteful. Judicious cutting may go on forever without lessening the supply of timber which a forest contains, while refraining for all cutting is like letting fruit or growing crops go to decay. The trees that are ripe for use may give place to others which will keep up the succession and preserve forever the integrity of the forest; and few indeed are the public measures which would do as much for the general welfare as insisting on this amount of conservation."